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# Alternative Interconnection

## System Impact / Facilities Study

### **Generation Interconnection**

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Los Esteros Critical Energy Facility, Phase I

Los Esteros Critical Energy Facility, LLC



Pacific Gas and Electric Company

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## 1. Summary & Project Description

Pacific Gas & Electric (PG&E) issued the Supplemental Facilities Cost Report (SFCR) on September 26, 2002 for Los Esteros Energy Center, LLC's (Applicant's) proposed Los Esteros Critical Energy Facility (LECEF) Project. That report contained the study results and costs associated with interconnecting the 195 MW of LECEF Phase I temporarily tapped off the Nortech Trimble 115 kV Line and, after the completion of PG&E's Los Esteros Substation, permanently interconnected via two generation tie lines to the Los Esteros Substation 115 kV bus. The Applicant has requested that PG&E study a new interconnection of the LECEF Phase I.

The proposed new interconnection would tap off either the Los Esteros – Nortech 115 kV Line, as shown in Figure 1-1, or the Los Esteros – Trimble 115 kV Line, as shown in Figure 1-2. This interconnection would be an alternative to interconnecting the project directly to the Los Esteros Substation 115 kV bus. Such an interconnection would occur in summer 2003. This SI/FS provides:

- 1) An evaluation of the transmission system impacts caused by the interconnection of the LECEF Phase I to either of the two lines.
- 2) The system reinforcement necessary, if any, to mitigate the adverse impact of the Project under various system conditions.
- 3) Cost estimates for the facilities, necessary to mitigate the adverse system impacts and to interconnect the project to the proposed new interconnection point.
- 4) Cost estimates and work scope for the facilities necessary to interconnect LECEF Phase I to PG&E's transmission system.

The LECEF is located at 1515 Alviso-Milpitas Road in San Jose, California. The LECEF Phase I has a maximum output of 195 MW to PG&E's grid. The project consists of four (4) gas turbine generators rated 71.2 MVA (nominal) each. Each generator has its own 13.8/115 kV step-up transformer.

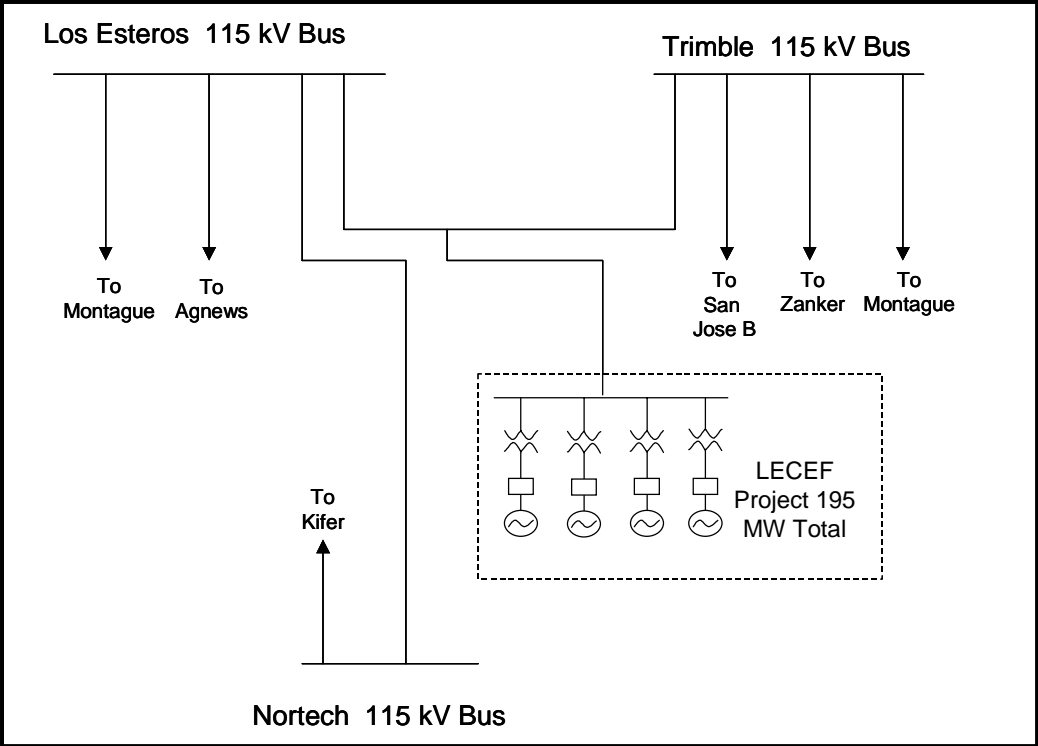


Figure 1-1: LECEF Tapped into the Los Esteros – Trimble 115 kV Line

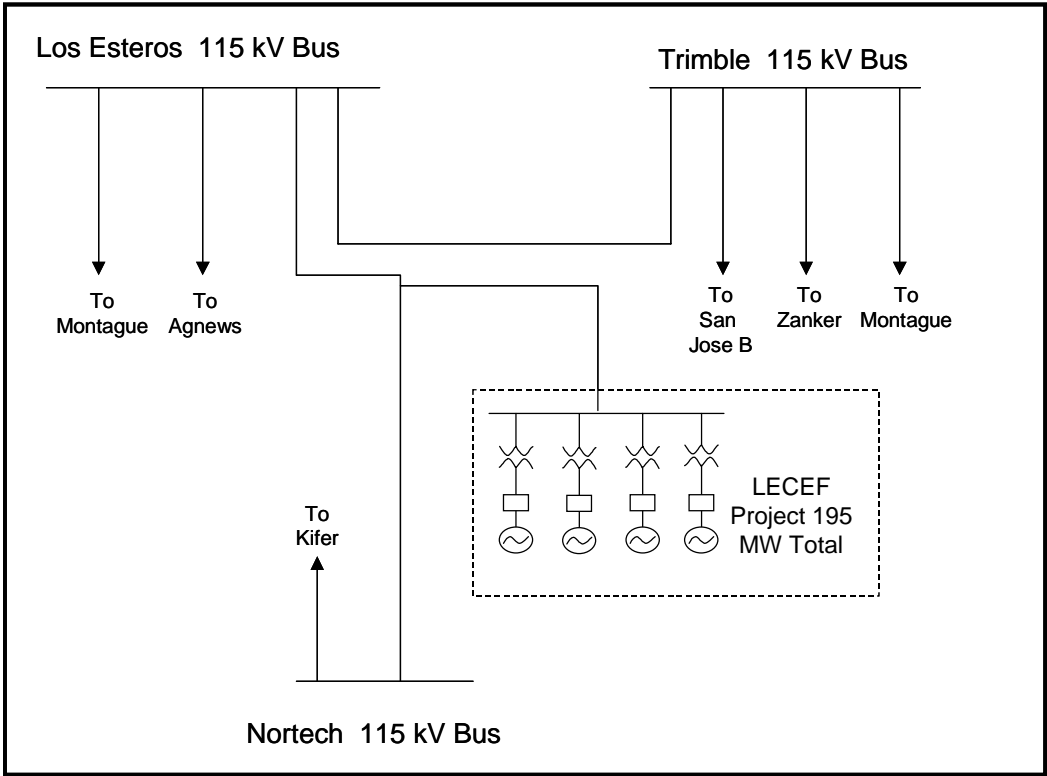


Figure 1-2: LECEF Tapped onto the Los Esteros – Nortech 115 kV Line

## 1.1 Conclusion

The results of the study indicate that LECEF Phase I would create no system impacts requiring mitigation. This is the case for either of the proposed (Los Esteros – Nortech Tap or Los Esteros – Trimble Tap) alternatives.

If Calpine decides to remain as a tap configuration after the Los Esteros Substation is built, PG&E recommends that Los Esteros – Nortech Tap alternative be selected. The Los Esteros – Nortech 115 kV line is the closest circuit to the existing LECEF tap line.

The cost for either interconnection would be approximately \$650 thousand.

## 2. Costs

A cost summary is provided in Table 2-1 with more detailed direct assignment interconnection costs provided in Subsection 2.1. Subsection 2.2 provides more detailed costs for network upgrades required to interconnect the project. Costs provided are not final and will need to be reconciled with actual costs upon completion of the project.

<b>Total Interconnection Cost before ITCC</b>	<b>\$110,000</b>	
<b>ITCC Tax @ 27 %</b>	<b>\$29,700</b>	
<b>Total Interconnection Cost with ITCC</b>	<b>\$139,700</b>	
<b>Total Upgrade Costs</b>	<b>\$510,000</b>	
<b>Total Costs</b>		<b>\$649,700</b>

Table 2-1: Cost Summary

## 2.1 Direct Assignment Generator Interconnection Facilities

Table 2-2 provides a summary of the cost estimates<sup>1</sup> for the facilities required to interconnect the LECEF Phase I Project with PG&E's transmission system. These are the facilities necessary to physically and electrically interconnect a New Facility Operator to the ISO Controlled Grid at the point of interconnection. Please note that these costs are not final and will need to be reconciled with actual costs upon completion of the project.

<b>Transmission Line Costs</b>	<b>\$100,000</b>
Engineering, project management and construction of tap interconnection. Removal of existing interconnection.	
<b>Telecommunication Costs</b>	<b>\$10,000</b>
Engineering, design drafting and construction at LECEF site	
<b>Total Direct Assignment Interconnection Cost before</b>	<b>\$110,000</b>

<sup>1</sup> PG&E interconnection engineering cost estimates are developed with a theoretical confidence level of 25 percent. Billing will be based on an actual cost basis.

<b>ITCC</b>	
<b>ITCC<sup>2</sup> Tax @ 27%</b>	<b>\$29,700</b>
<b>Total</b>	<b>\$139,700</b>

Table 2-2: Direct Assignment Cost Summary

## 2.2 Network Upgrades Costs

Table 2-3 provides a summary of the cost estimates<sup>3</sup> for upgrades to the system that would be required to interconnect the project. If the study determines they are required, network upgrades would also include those facilities necessary to mitigate the overloaded and overstressed equipment caused by the new facility. These include network upgrades necessary to remedy short circuit or stability problems resulting from the interconnection of a New Facility Operator to the ISO Controlled Grid. Reliability Upgrades also include, consistent with WECC practice, the facilities necessary to mitigate any adverse impact a New Facility's interconnection may have on a path's WECC path rating. Also included are those facilities necessary to relieve constraints on the ISO Controlled Grid and to ensure the delivery of energy from a new facility to Load.

<b>Transmission Line Costs</b>	<b>\$400,000</b>
Engineering, project management and construction of transmission tower and line interconnection.	
<b>Substation Costs</b>	<b>\$40,000</b>
Engineering, project management, & construction required to replace relays and change relay setting at Nortech Substation, add new relays at Los Esteros Substation	
<b>Telecommunication Costs</b>	<b>\$70,000</b>
Engineering, design drafting and construction at PG&E Substations & on transmission line	
<b>Total</b>	<b>\$510,000</b>

Table 2-3: Network Upgrade Cost Summary

<sup>2</sup> Funds and property received by the Utility in order to provide utility service are considered as income by both the Federal Government and the State of California. From IRS Notice 87-82, Section III on Fair Market Value of Income Tax Component of Contribution (ITCC), "[a] Utility shall include as income the amount of any cash received as a CIAC (Contribution in aid of construction) and the fair marketing value of all property received as a CIAC." ITCC charge is collected from a customer to keep PG&E's ratepayers from being negatively impacted by the customer's service.

The ITCC tax charge represents the current tax rates, which PG&E must pay on its revenue to the Federal Government and the State of California. PG&E's current tax rate for electric revenue is 27%.

Interconnection costs may meet the criteria necessary to qualify for a safe harbor provision under IRS Notice 2001-82.

If it is determined that these interconnection facilities meet the requirements for a safe harbor, PG&E will require the generator to provide a security that the generator will pay the tax costs if the contribution is later found to be a taxable event. The generator must also provide a warranty that the interconnection meets the requirements of the safe harbor.

<sup>3</sup> The PG&E Reliability Upgrades cost estimates are developed with a theoretical confidence level of 50 percent. Billing will be based on an actual cost basis.



## 2.3 Tentative Construction Schedule

The tentative schedule to engineer and construct the facilities based on the work outlined in this SI/FS is approximately three to four months from the signing of the Generator Special Facilities Agreement (GSFA). This assumes that the Applicant's CEC Application is deemed adequate for permitting all PG&E activities. If the CPUC determines additional permits are required, the project could require additional time of unknown duration.

## 3. Study Assumptions

PG&E conducted the System Impact/Facilities Study using the following assumptions:

- 1) The gross MW output from the LECEF to the PG&E transmission grid will be 195 MW.
- 2) The Silicon Valley Power (SVP) peak loads during 2003 will be modeled at approximately 530 MW to reflect the latest SVP load projection.
- 3) The study took into account the planned generating facilities ahead of the LECEF's queue position. These facilities are shown in Attachment 1 of the Study Plan in [Appendix A](#).
- 4) The study took into account all the approved PG&E transmission reliability projects that will be operational by Summer 2003.

## 4. Steady State Power Flow Studies

Two power flow cases were used to evaluate the transmission system impacts of the LECEF.

### 1. 2003 Summer Peak Full Loop Base Case:

Power flow analysis was performed using PG&E's 2003 Summer Peak Full Loop Base Case (in General Electric Power Flow format). This base case was developed from PG&E's 2002 base case series. It has a 1-in-10 year heat wave load forecast for the Diablo, Mission, De Anza, and San Jose areas.

### 2. 2003 Summer Partial Peak Full Loop Base Case:

Power flow analysis was also performed using PG&E's 2003 Summer Partial Peak Full Loop Base Case (in General Electric Power Flow format). The PG&E Area conforming load levels are reduced approximately 22% from the levels shown in the Summer Peak Full Loop Base Case. This is

representative of a typical morning of a summer peak day.

The two base cases were used to simulate the impact of the new facility during normal operating conditions, as well as, single (ISO Categories “B”) outages. The study covered the transmission facilities within PG&E’s San Jose planning areas.

The single (ISO Category “B”) contingencies include the following outages:

#### 4.1 ISO Category “B”

- All single generator outages within the study area.
- All single (60 - 230 kV) transmission circuit outages within the study area.
- All single transformer outages within the study area.
- Overlapping single generator and transmission circuit outages for the transmission lines and generators within the study area.

[Appendix B](#) provides the contingency list for the CAISO Category B outages.

#### 4.2 Results

[Appendix C](#) provides the Steady state power flow results for the normal and Category B conditions. [Appendix D](#) includes selected power flow plots for summer peak and spring peak operating conditions. In the Appendices, the Los Esteros – Nortech interconnection is referred to as Alternate 1 and the Los Esteros – Trimble interconnection is referred to as Alternate 2.

##### 4.2.1 2003 Summer Peak

LECEF Phase I would cause no new normal overloads or increase any pre-project normal overloads during 2003 Summer Peak conditions.

During 2003 Summer Peak emergency conditions, the LECEF Phase I would create new overloads and cause some existing overloads to be increased on one (1) transmission line following some Category B contingencies for both interconnection alternatives. That line is the:

- Kifer-Scott 115kV line

The overloads for this line are summarized in Table 4-1.

Contingency	Rating	Pre- Project		Post-Project		% Change from Pre- Project Loading
	(Amps)	Loading (Amps  %Rating)		Loading (Amps  %Rating)		
Alternate 1 – Los Esteros – Nortech 115 kV Interconnection						
Newark - NRS #1 115 kV and SVP Gianera Generator Unit 1	949	1,062	112%	1,143	120%	+8%
Newark - NRS #2 115 kV and SVP Gianera Generator Unit 1	949	1,051	111%	1,134	120%	+9%

Contingency	Rating	Pre- Project		Post-Project		% Change from Pre- Project Loading
	(Amps)	Loading	(Amps  %Rating)	Loading	(Amps  %Rating)	
Alternate 1 – Los Esteros – Nortech 115 kV Interconnection						
Swift - Metcalf 115 kV and SVP Gianera Generator Unit 1	949	828	88%	955	101%	+13%
Newark D-Northern 115 kV Line	949	1,002	106%	1,083	114%	+8%
Newark F-Northern 115 kV Line	949	989	104%	1,072	113%	+9%
SVP Gianera Generator Unit 1	839	750	90%	878	105%	+15%
SVP Gianera Generator Unit 2	839	750	90%	878	105%	+15%
Newark - NRS #1 115 kV and Agnew Co-gen	949	993	105%	1,073	113%	+8%
Newark - NRS #1 115 kV and SVP CCA Generator	949	978	103%	1,058	111%	+8%
Alternate 2 – Los Esteros – Trimble 115 kV Interconnection						
Newark - NRS #1 115 kV and SVP Gianera Generator Unit 1	949	1,062	112%	1,127	119%	+7%
Newark - NRS #2 115 kV and SVP Gianera Generator Unit 1	949	1,051	111%	1,120	118%	+7%
Newark D-Northern 115 kV Line	949	1,002	106%	1,068	113%	+7%
Newark F-Northern 115 kV Line	949	989	104%	1,058	111%	+7%
SVP Gianera Generator Unit 1	839	750	90%	855	102%	+12%
SVP Gianera Generator Unit 2	839	750	90%	855	102%	+12%
Newark - NRS #1 115 kV and Agnew Co-gen	949	993	105%	1,058	111%	+6%
Newark - NRS #1 115 kV and SVP CCA Generator	949	978	103%	1,043	110%	+7%

Table 4-1: Category B Emergency Overloads – Summer Peak 2003

#### 4.2.2 2003 Summer Partial Peak

LECEF Phase I would not cause any new overloads or increase any pre-project overloads during 2003 Summer Peak conditions during normal conditions or after any Category B contingencies.

### 4.3 Mitigation

#### 4.3.1 Scott – Kifer 115 kV Line

Silicon Valley Power (SVP) owns the Scott – Kifer 115 kV line. SVP has informed PG&E that they are currently in the process of reconductoring this line with bundle 954 AAC conductors. The new conductor size is large enough to mitigate the existing and increased overloads caused by LECEF Phase I. The reconductoring is expected to be complete prior to Summer 2003. If this reconductoring work is delayed, LECEF Phase I may be required to curtail generation until it is completed.

## 5. System Protection Study

Short circuit studies were performed to determine the impact of adding LECEF to the transmission system. The fault duties were calculated before and after the project. Calpine provided the input data used.

### 5.1 System Protection Study Input Data

Following are data for each LM6000 unit and each GSU:

Generator Base MVA = 71.176

- Synchronous reactance ( $X_d$ ) = 2.35 pu
- Transient reactance ( $X'_d$ ) = 0.245 pu
- Sub-transient reactance ( $X''_d$ ) = 0.181 pu
- Negative Sequence reactance ( $X_2$ ) = 0.141 pu (sat)
- Zero Sequence reactance ( $X_0$ ) = 0.095 pu (sat)

Step-up Transformer, 13.8/115 kV, 40/50/60 MVA

- $Z = 8\%$  @ MVA

### 5.2 Results

Tables 5-1 and 5-2 below provide the available short circuit ampacity at the buses studied for the Alternate 1: Los Esteros – Nortech 115 kV tap alternative and the Alternate 2: Los Esteros – Trimble 115 kV tap alternative.

STATION		EXISTING DUTY			NEW DUTY		
Name	Voltage	3 PHASE (A)	SLG (A)	3 PHASE (A)	% Increase	SLG (A)	% Increase
Los Esteros 115 kV	115 kV	36,700	36,500	39,700	8%	39,600	8%
Milpitas 115 kV	115 kV	18,300	15,400	18,400	1%	15,400	0%
Newark Sect. D115 kV	115 kV	38,900	41,100	39,500	1%	41,600	1%
Newark Sect. E & F 115 kV	115 kV	56,000	56,900	57,300	2%	57,800	2%
Kifer 115kV	115 kV	33,500	32,300	35,600	6%	34,100	6%
Trimble 115kV	115 kV	32,700	31,000	34,500	6%	32,500	5%
Montague 115kV	115 kV	23,800	21,200	24,800	4%	21,800	3%
Nortech 115kV	115 kV	30,200	26,300	34,400	14%	32,300	23%

Table 5-1: Short Circuit Duties For Los Esteros – Nortech Tap Alternative

STATION		EXISTING DUTY			NEW DUTY		
Name	Voltage	3 PHASE (A)	SLG (A)	3 PHASE (A)	% Increase	SLG (A)	% Increase
Los Esteros 115 kV	115 kV	36,700	36,500	39,700	8%	39,600	8%
Milpitas 115 kV	115 kV	18,300	15,400	18,400	1%	15,400	0%
Newark Sect. D 115 kV	115 kV	38,900	41,100	39,400	1%	41,500	1%
Newark Sect. E & F 115 kV	115 kV	56,000	56,900	57,200	2%	57,800	2%
Kifer 115kV	115 kV	33,500	32,300	34,700	4%	33,200	3%
Trimble 115kV	115 kV	32,700	31,000	33,800	3%	31,800	3%
Montague 115kV	115 kV	23,800	21,200	25,700	8%	23,100	9%
Nortech 115kV	115 kV	30,200	26,300	31,600	5%	27,200	3%

Table 5-2: Short Circuit Duties For Los Esteros – Trimble Tap Alternative

The minimum interrupting rating for the circuit breakers at the effected busses is shown in Table 5-3 with the exceptions noted below.

STATION		Breaker Minimum Interrupting Rating (Amps)
Name	Voltage	
Los Esteros	115 kV	63,000
Milpitas	115 kV	40,000
Newark Sect. D	115 kV	44,000
Newark Sect. E & F	115 kV	63,000
Trimble	115 kV	40,000
Montague	115 kV	25,000
Nortech	115 kV	40,000

Table 5-3: Minimum Circuit Breaker Interrupting Rating

There are four (4) 115 kV breakers at the Newark Substation Sect “E” & “F” 115 kV (CB 350, 480, 520, and 540) with interrupting ratings of 47,750 Amps. The increase caused by LECEF Phase I is less than 2 %. According to PG&E’s current policy, the Project is not responsible for replacing the breakers. PG&E will address these overstressed breakers under PG&E’s overstressed breaker replacement program.

## 6. Substation Evaluation

[Appendix E](#) provides a work scope for the substation work required for the proposed interconnection of the Los Esteros Critical Energy Facility Phase I. Cost estimates for this work scope are provided in [Section 2](#).

### 6.1 Overstressed Breakers

PG&E uses the following policy for projects that overstress or increase the level of overstress<sup>4</sup> on existing circuit breakers.

<sup>4</sup> Overstressed Circuit Breaker – The percent of overstress, or level of overstress, is the percent of maximum fault current above the breaker’s nameplate rating. For example, a breaker rated at 40,000 amps symmetrical current interrupting a 44,000 amp symmetrical fault is overstressed by 10%.

- If a breaker is not overstressed and a project results in an overstressed condition of the breaker.
- If a breaker is already overstressed and a project increases the overstress by 5% or more, or the overstress level exceeds 25%.

According to the policy above, the project would not be responsible for the replacement of any overstressed equipment.

## 7. Land Evaluation

PG&E's Building & Land Services Department (BLS) has reviewed the alignment into the proposed interconnection of the Los Esteros Critical Energy Facility Phase I and determined that no additional land rights would be required for the interconnection. Existing rights will have to be modified to reduce easement length.

## 8. Transmission Line Evaluation

Transmission Engineering has developed a cost estimate and workscope for the work required to interconnect Los Esteros Critical Energy Facility Phase I to PG&E's grid. This cost estimate is included in [Section 2](#).

### 8.1 Interconnection Workscope

- Design of the tap from the future Los Esteros-Nortech 115 kV circuit and the crossing with the LECEF 115 kV Tap (located between Structures 0/2 and 0/3). PG&E has proposed using PG clamps on the Los Esteros-Nortech 2-715 kcmil AAC lines, and compression 15° Jumper Terminals on the end for bolting into the existing compression dead ends on the wood pole LECEF 115 kV Tap using 12-aluminum adaptor plate.
- Relocate termination point of existing ADSS fiber optic line from splice box located at TSP 31 on Nortech-Trimble 115 kV line to splice box located on Structure 0/1 of Los Esteros-Nortech 115 kV line.
- Construct the tap between Los Esteros-Nortech 115 kV and the existing LECEF 115 kV Tap.

### 8.2 Network Upgrades

- Design and construct the 115 kV switch required by Operations
- Replace future Los Esteros-Nortech Structure 0/4A with TSP designed for new 115 kV switch
- Switch will permit the 115 kV line between LECEF 115 kV Tap and Nortech Substation to be disconnected. Switch will be designed to handle line dropping (about 1.0 amp charging current) and no loop switching

The LECEF 115 kV Tap will not have switching capabilities on the Los Esteros - Nortech 115 kV line itself. The LECEF 115 kV Tap can be separated from Los Esteros-Nortech at breakers located within the LECEF Plant, not by any PG&E owned or operated switches

## 9. Communications

PG&E Telecommunications Department has determined the work required for the alternative interconnection of Los Esteros Critical Energy Facility Phase I. Costs for the work are shown in [Section 2](#).

### 9.1 Workslope

New fiberoptic cable will have to be routed underground from the LECEF control building to the Los Esteros substation control building. Approximately 400 ft of new 4" duct will have to be installed from the point where the existing fiber lines enter the underground duct at the bus structure at LECEF to a point within the Los Esteros Substation where it would connect to the PG&E communications duct system within the substation. New fiber line will be pulled in between the two control rooms. This will allow the LECEF to remain on line while the work is completed.

## 10. Study Updates

This SI/FS was performed according to the assumptions shown in the Sections titled "Study Assumptions". In the event that these assumptions are changed, an updating study may be required to re-evaluate LECEF's impact on PG&E's transmission grid. Applicant would be responsible for paying for any such updating study. Examples of changes that might prompt such a study are:

- Change in interconnection date.
- Change in Interconnection Queue position